Radio Method of Blind Landing

by T-2003

A detailed explanation of the new method by which the U. S. Army Air Corps makes blind landings possible by radio wave control. Thus, safety to planes is insured even in the densest fogs.

EARLY one morning in May, 1932, at the Army's test flight grounds near Dayton, Ohio, a small group of officers and civilian technicians from Wright Field gathered about a basic training plane which, although a two-seater, had nothing more than a sandbag in the rear cockpit.

Forward, in the pilot's seat, a chunky compact figure sat and grinned as he looked about him. The engine was "tocking" over idly and a gentle west wind blew over the hill to one side of Patterson Field.

Without further ado, the pilot reached back and pulled a canvas "canteloupe" hood over his head, a hood that shut off all view of the outside world to him, leaving visible only the airplane's lighted instrument board.

"Good luck, Hegey," a fellow pilot shouted earnestly, for Captain Albert F. Hegenberger, who in 1927 had first flown the United States-Hawaii passage with Maitland, was now about to make another premier flight, this time entirely solo.

The propeller leaped to life, the plane dragged forward and its speed increased. Its tail lifted until the fuselage was level, then the plane, guided by the pilot whose actions at the controls were guided in turn by the instruments before him, rose from the ground and flew on into the West wind. The little group of fellow scientists breathed with relief, then settled down to their jobs at various radio devices, or just watched and waited.

For ten minutes the Army pilot flew in the vicinity of the city of Springfield after having made an easy turn in that direction. He had no view of Ohio's horizon, but an artifical one on his instrument board told him when he was banked, or flying level or nose up or nose down. Soon, over the radio receivers on the ground, came the laconic words, "I'm coming in."

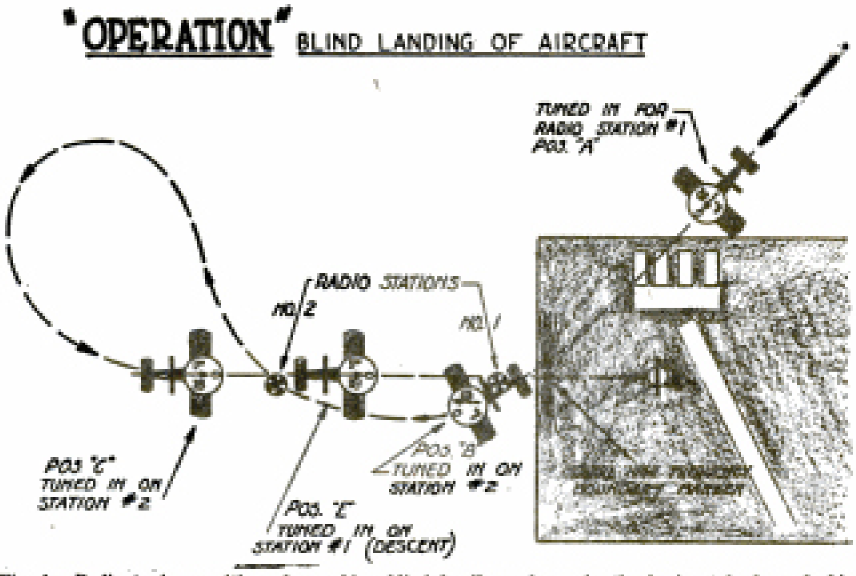

Fig. 1. Radio tuning positions for making blind landings shown in the horizontal plane, looking down upon the field.

THE airplane came into view, this time to leeward of the field and headed into the wind. From a height of 1,000 feet it floated in, nose up a bit, but power half on, to give it a few more miles per hour than its landing speed. The hood could be seen tightly closed over the pilot, but his instruments gave him sufficient knowledge of where his airplane was at each instant. The plane floated in closer to earth and to the center of the landing runway, then the wheels touched and, with a short roll, the plane came to rest.

The first *blind solo* flight had been made!

It was three years before this, that Jimmie Doolittle at Mitchel Field, New York, had made the first complete blind flight, take-off, flight and landing on record; carrying with him, however a safety pilot or look-out in the rear seat. Doolittle had demonstrated that it could be done.

In the meantime, Captain Hegenberger, in charge of instrument development in the Equipment Branch at Wright Field, continued working to devise a simple system of ground installation applicable to military use, as well as to perfect the instruments in the airplane to make blind flying as simple a procedure as ordinary flying. The airplane installation gave little trouble, but on the ground it presented a problem peculiar to the Army Air Corps.

The primary interest of this branch of the armed forces is in the military phases of aviation and a ground installation for blind take-off and landings which might be applicable to commercial aviation might not be practicable for military air operations. That is, a commercial layout could be a permanent one, but the Air Corps needed a completely portable apparatus, as it is not expected that permanent airdromes

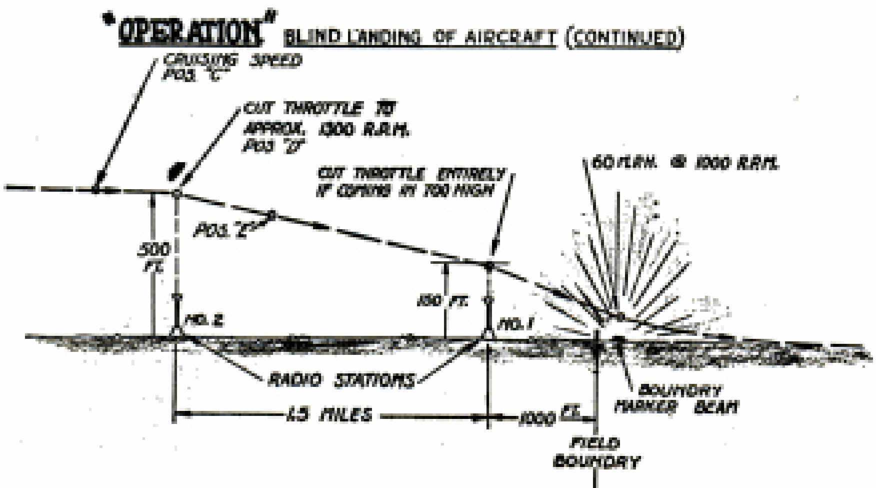

Fig. 2. Making a landing by the radio method shown in the vertical plane.

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would be available for Uncle Sam's air forces in the theater of operations in time of war.

With the apparatus now in use by the Air Corps it will be perfectly possible for a group commander, who has selected a landing field for each of his squadrons, to send a transport plane carrying a complete set of such apparatus into each of the squadron fields. These fields could then be flown in all kinds of fog. In fact, it might even be advantageous to select an area for such fields where fog is prevalent if possible, as such fog would not prevent our own air forces from using such fields but would blanket them from the inquiring eyes of the enemy air force observation crews.

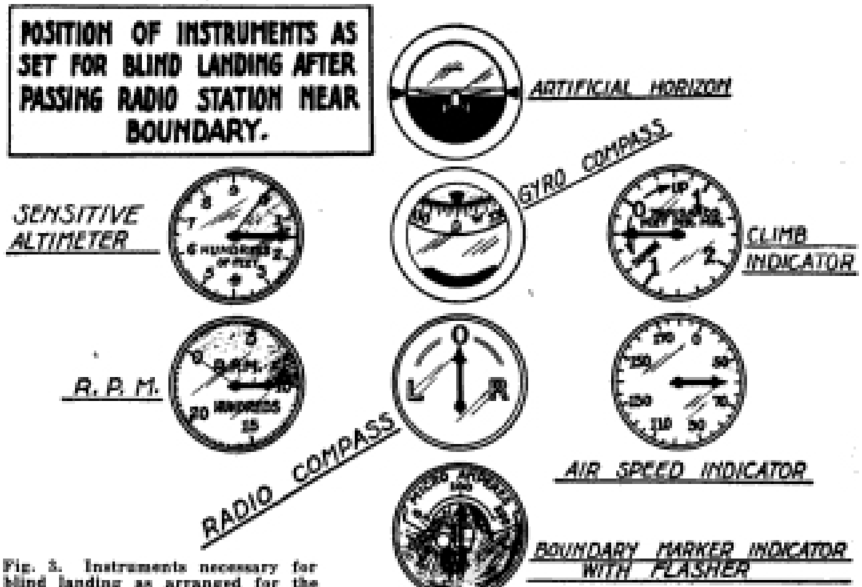

Fig. 3. Instruments necessary for blind landing as arranged for the new system.

THE necessity for blind flight is a real one and such flights are not mere stunts, but are an indication that the same flying can be done in foggy weather, which shuts out all view of the outside world to the pilot as effectively as does his hooded cockpit when he practices these blind flights.

Straight blind, fog flying, or instrument flying, to call it by its various names, is part of the routine training of both student and finished pilots in the Army, as it is in the flying services of other countries. So many hours each year must be spent at a safe altitude in the air at the controls and beneath the closed hood, sometimes even on extended flights. A bored fellow pilot in the observer's cockpit just sits there and checks up.

This flying training is really easier than the camera obscura practice of the bombardment flyers, or that of hooking up message bags from the ground as practiced by the boys in the observation squadrons. The air mail pilots go through hours and hours of such blind flying in the course of a month; not as a matter of practice with a hooded cockpit, but through real fog or "soup," as part of their day's or night's work.

"After a week or so of sloppy weather you can't bear a steamy shower bath nor even a light grey suit of clothes," remarked a well-known air mail pilot to the author; "it reminds you too much of the old 'soup'."

In blind flying practice, if the pilot runs into a cloud stratum, he can lift the hood and still get credit for blind flying practice. The situations are identical except for the lookout in the observer's cockpit. In the 19th Bombardment Group at Rockwell Field, San Diego, California, Captain W. T. Larson generally acts as "chaperon" for the routine blind aviation flights scheduled for all the pilots in the group.

On one such flight, a dense fog was encountered between Rockwell Field and March Field, their destination. The pilot under the closed hood, oblivious to the weather, pushed on serenely. Larson, however, admits having been torn between nervousness and confidence in the instruction he'd already given the pilot. At the scheduled time, the hangar line at March Field was suddenly visible, although dimly, right below the plane.

TAKING off in the fog and getting to that "safe altitude" and climbing down out of it back to the ground completes the cycle and definitely licks the weather. Except maybe for ice, which is still unlicked. Perhaps one or more of the devices now being developed to prevent ice in a freezing mist from forming on wings and struts will do the trick and prove practicable. That may be next Winter, or that following.

As this is being written, my friend and host Lieutenant Bill McKiernan, the regular Army Air Corps instructor of the New Jersey National Guard Squadron at Newark, interrupts me to describe the complete blind cross country flight made several months ago by James L. Kinney. This Department of Commerce pilot took off from College Park, near Washington, D. C., in a dense fog, flew the 200 miles to Newark through "the soup" and landed at Newark in but slightly better weather with the aid of a buried cable installation under the airport.

As far as military flying is concerned, it means that if the objective on the ground is visible from the air and can be found, fog will not prevent an airplane nor a fleet of them, from getting there and returning to their base. In fog they are safe from attack from enemy's pursuit aviation and from his anti-aircraft artillery. In fact, one of the tricks of the trade in long range air reconnaissance into enemy territory is flying there and back through any available layer of clouds —and the thicker the safer.

Indeed, foggy mornings around Dayton invariably see Captain Hegenberger leave his office at Wright Field, motor to Patterson Field adjacent to the experimental station and there make his flights, solo or accompanied by another pilot or technician. Sometimes the weather is so thick that the plane often disappears from the sight of those at the hangar line before it has left the ground.

THE Air Corps Materiel Division at Wright Field has been working for the past four years on a number of systems, three of which gave promise of being the final solution, but only one has proven practicable for actual use in military aviation.

"As an example," to quote Major C. W. Howard, Chief engineer at Wright Field, in a recent report to the Chief of the Air Corps, "a system of underground cables developed by the French, marked the boundary of the landing field both in horizontal and vertical dimensions and was tried out on a small scale installation. It was found that not only the special equipment required for installation in the airplane was too heavy, but that the adoption of a cable system for emergency airdromes in war times would be of questionable use in view of the difficulties in transporting and installing cables.

"Another system utilized the airways radio beacon to guide the pilot to the airdrome and a portable direction beacon to show the direction for landing, together with instruments that had been developed primarily for avigation. The aim in these developments was to utilize instruments for installation in the airplane that could also be used for flight aids under normal conditions. The ground installations must be portable, light, and simple to set up, install and operate.

"This had led to the substitution of the radio compass and two small radio transmitters for the airways and portable directional beacons. This latter principle was demonstrated to be practical. The apparatus installed in the

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Goshawk

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giving them 3 or 4 coats of banana liquid, so that they will have a smooth and glossy finish.

Cement all cabane or center section struts in position to receive upper wing panel. Cement wing panels to these struts making sure you have the proper alignment. The lower wing panels are now cemented to the two cross braces, which are cemented to the two bottom longerons.

Block the tips up properly so that they have the correct incidence and 2° dihedral angle at the tips. After this has been completed, the end struts are cemented in their proper locations. Use a needle and thread in installing the flying, landing and bracing wires.

PROPELLER

Many model builders require two types of propellers. One for flying and one for display purposes. We have correctly shown on the plan how to construct both of these types. The flying propeller is very simple to construct.

A propeller with a broader face than the scale propeller is necessary in order to contact a sufficient amount of air to drive the model and to hold down the speed of the rubber motor. Another important item is the bearing which must allow the propeller shaft to turn freely and yet must be tight enough to prevent "wabbling" or vibration.

FLYING THE MODEL

Where possible, it is best to give the model a gliding test over tall weeds before attempting to fly it with the motor. When properly balanced, it should glide steadily without diving or stalling.

END.

Landing

(Continued from page 156)

airplane consisted only of the radio compass, flight indicator, (gyro horizon), turn indicator (gyro compass), sensitive altimeter, airspeed indicator, and the usual engine instruments. For the ground installation a small transmitter was used at the end of the landing runway in the vicinity of the boundary, or a little beyond, a similar transmitter was located one or two miles farther away in prolongation of a line drawn through a point in the landing area and the transmitter near the boundary of the area."

An additional device is an ultra-high frequency boundary marker, a low range transmitter set just inside the field's boundary line. These devices, all portable, are lined up so that they head toward the field and into the wind, the same direction in which an airplane should be landed.

The sonic altimeter which registers its height above the ground when used in an airplane was one of the devices tested but abandoned in favor of the sensitive pressure altimeter, as the sonic device weighed 35 pounds and required too much concentration in its use at a time when the senses were needed for a number of other things.

LET us imagine an Army pilot on an extended avigation flight nearing an airdrome and encountering fog which, from the radio weather reports, he learns is blanketing his destination in dense fog to a height of two thousand feet. The pilot switches on his transmitter and picks up his microphone.

"Patterson Field, Patterson Field, this is Army plane O-38, number 31-437, over Columbus, Ohio, Lieutenant Blank with one passenger, from Bolling Field to Patterson. What are weather conditions there? May I land there? Answer, please." He switches on to "Receive." In a moment the reply comes back.

"Army plane 31-437, Lieutenant Blank, this is Patterson Field. Dense fog. Come in blind, our apparatus O.K. Here are weather conditions—East wind 8 miles, field firm and dry, barometer two nine point eight seven. Repeat."

The pilot repeats the data to insure the correctness of his reception, then turns to the sensitive altimeter on the instrument board and sees that when he left Washington it had been set at sealevel with the barometer at 29.95 inches. His map shows his destination as 830 feet above sea level. He sets back the altimeter these 830 feet and *further* adjusts it for the difference in *barometric pressure*. The altimeter is now set so that it should read zero when he had landed at Patterson Field.

His map also shows a ridge of ground between Columbus and Dayton and he takes care that he flies high enough to clear all possible hills and other obstructions. A few miles outside of Columbus he sees the fog, damp looking wisps of steam near the ground, which becomes thicker and higher as he flies on until soon he is enveloped in its clammy depths, or rather, heights, with beads of water dripping off his struts. He is flying toward the radio range beacon at Wright Field, the long letter "T" droning in his ears and assuring him that he is on the proper course.

When the loudness of this range signal and the clock also, tell him that he is within several miles of the landing area, he turns the receiver to the wavelength of the nearest portable radio landing station and watches his radio compass carefully. When he is headed for the station the needle on this instrument points to zero. (see Fig. 1).

He is now at position (A), losing altitude rapidly until he is within 200 feet of the ground. He passes over station No. 1, or position B, Fig. 1, and his radio compass needle jerks to one side. He then tunes in on station No. 2, by a mere flip of a switch and flies toward that station, crosses it and makes an easy 180 degree turn to head his airplane back to the field along the desired direction, into the wind.

He is now coming in to land, his artificial horizon guiding his hand at the stick to maintain the airplane level and the gyro and radio compasses telling him when he is "headed for home." (Position C, Figs. 1 and 2.)

At "D", (Fig. 2) the needle of his

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radio compass twitches and he quickly switches it on to the wavelength of station No. 1. He should now be about 500 feet above the ground, according to his sensitive altimeter and he retards or advances the throttle until his tachometer reads 1300 r.p.m. He is descending now, (Position E, Figs. 1 and 2) and the needle of the altimeter is slowly working toward zero, with the radio compass needle reading zero if the pilot is properly heading into the wind, toward station No. 1. Again the needle twitches and his altimeter shows him 150 feet off the ground.

NOW comes the actual operation of landing. The throttle is cut to about 1,000 r.p.m. and the nose of the airplane pulled up a bit until the air-speed indicator shows a speed of about 60 miles an hour. (We are assuming an observation type airplane, normally loaded except for an almost depleted fuel supply and hence an airplane considerably lightened.)

The fog may be thin enough to give the pilot a view of the ground but he "sticks to his needles" and keeps his eyes glued on the instrument board before him. (Fig. 3) A bulls-eye flashes on one of the dials, he has passed the edge of the landing field itself. He is losing altitude at the rate of 400 feet per minute, according to the climb indicator and his nose is still up and the airplane almost in landing position, with just a few miles an hour more speed than stalling speed (Fig. 3.) A bump and perhaps a bounce or two—perhaps not—for many perfect landings have thus been made.

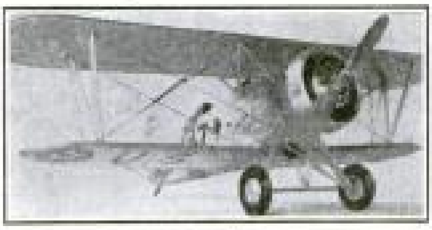
He is on the ground inside the landing area, perhaps the fog is still so thick that he cannot see the hangar line, but *must use his instruments to taxi there!* That, too, has been done in the past and will be done again in the future.

And speaking of the future, "I imagine the next thing to do is try it out in a two or three-ship formation in an actual fog," stated Captain Hegenberger to the author. "Of course, the cockpit hoods will not be used, they are nothing more than substitute for fog anyway, but the fog must be *thin* enough to allow the wing men to see their leader. When he turns, they turn; when he cuts his gun and pulls up his nose, they do likewise, and with him float down to a landing. The leader must observe the same precautions he would in an ordinary formation flight and landing, not to make any maneuver or change in speed too abruptly and land far enough out on the field so that the wing men do not stall down on the boundary fence behind him."

"Captain 'Joe' Cannon, the pursuit instructor at the Advanced Flying School, Kelly Field, when I was there as a student, used to lead a three-ship formation into the densest clouds, himself in the leading ship which was equipped for fog flying," remarked a young Army flyer recently graduated from Kelly Field. "The other two ships were piloted by students with less than 200 hours flying time to their credit. Thus, did the Army solve the blind landing problem—somewhat complicated, perhaps but entirely practicable and workable.

END.

Boeing F4B4 Pursuit



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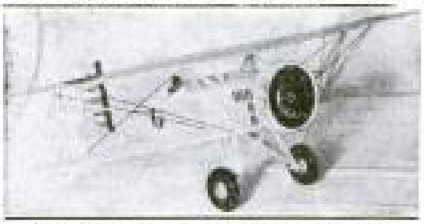

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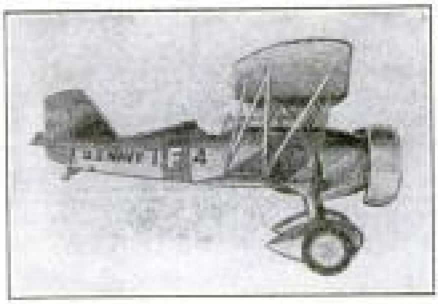

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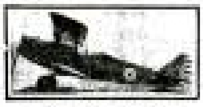

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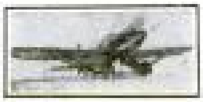

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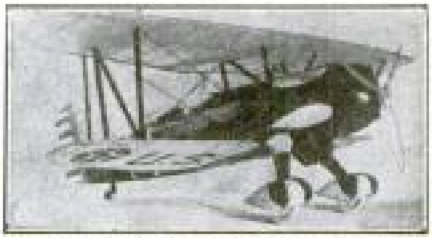

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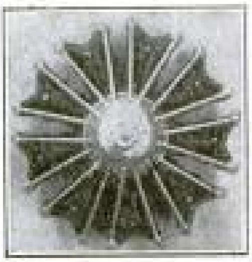

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